

2023 LASSO Update: CACTI Release, Starting ENA, and Beyond

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ARM

What is LASSO?



Southern Great Plains Observatory, Oklahoma

The U. S. Department of Energy's Atmospheric Radiation Measurement (ARM) facility's **Large-Eddy Simulation (LES) ARM Symbiotic Simulation and Observation (LASSO)** activity supplements ARM observations using high-resolution simulations.

Simulation libraries are built around ensembles of simulations, from kilometer to large-eddy-scale, that are vetted with observations and made freely available to the community.

These libraries provide foundational modeling to speed further studies by researchers, either through direct use of the output or through application of the successful model forcings in their specialized modeling objectives.

Motivation for LASSO

- Leverage high-resolution modeling to enhance the value of ARM's observations for researchers
- Bridge the scale gap between observations and models used for weather and climate simulations
- Provide observationally vetted LES as a plausible proxy for unobserved details

Scenarios

LASSO "scenarios" focus on particular suites of observations and weather regimes. Current scenarios:

- Shallow convection at ARM's **Southern Great Plains (SGP)** atmospheric observatory in Oklahoma
- Deep convection during the **Cloud, Aerosol, and Complex Terrain Interactions (CACTI)** field campaign in the Sierras de Córdoba mountains of north-central Argentina
- Maritime boundary layer clouds at ARM's **Eastern North Atlantic (ENA)** observatory; under development

LASSO-CACTI and LASSO-ENA are the newest offerings and are highlighted to the right. LASSO-CACTI is available in beta with the full release imminent. LASSO-ENA is just starting development.

LASSO-CACTI Release Available



Mobile Facility #1, CACTI Deployment, Argentina

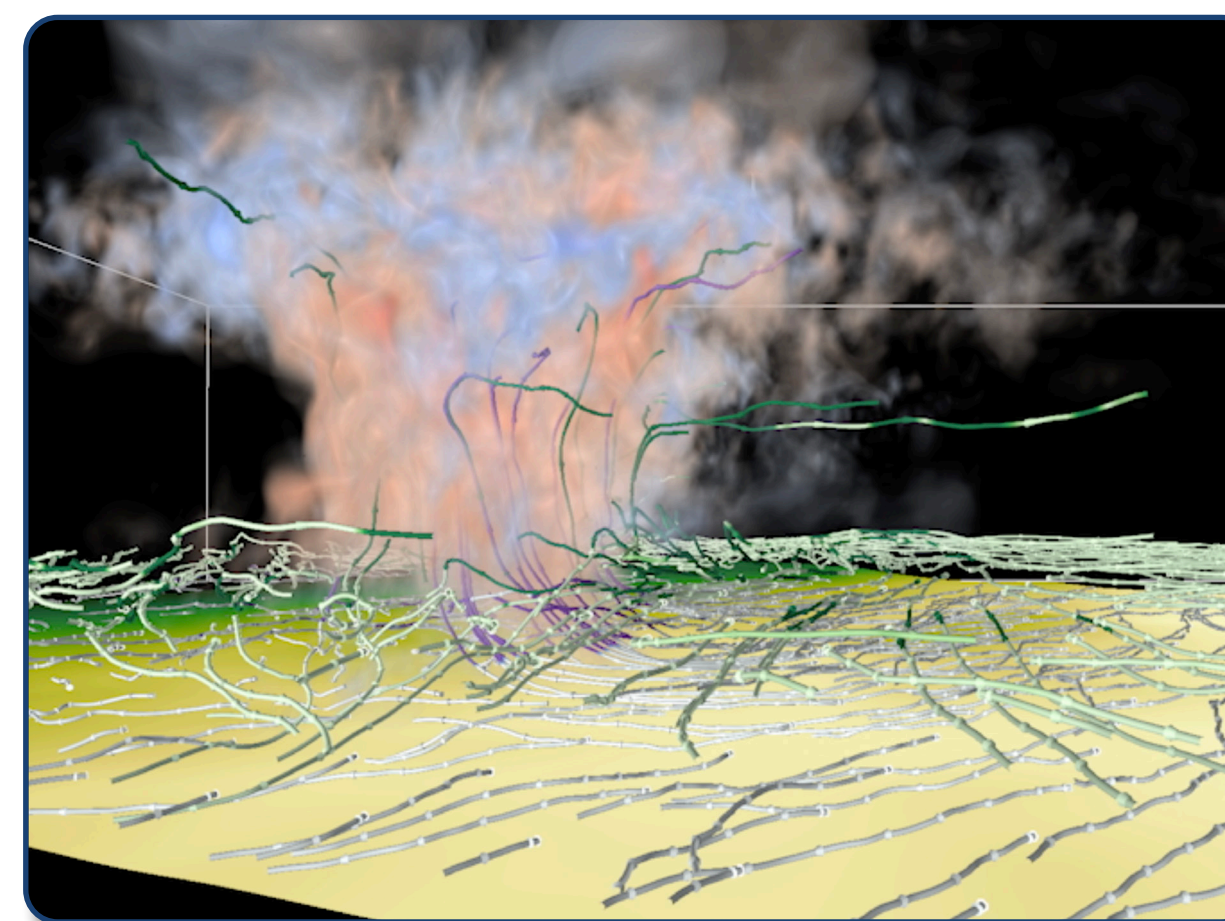
LASSO-CACTI focuses on deep convection initiation and initial growth of orographic clouds. This scenario uses a multi-scale approach to provide 33-member ensembles at 7.5 and 2.5 km grid spacings combined with select LES down to 100 m grid spacing for a subset of dates.

Ensemble members differ based on initial and boundary conditions, which provides users with a sensitivity to background environmental conditions for the convection.

Data Availability

The LASSO-CACTI Beta Release, made available last year, has evolved to include all available simulations.

- 20 case dates for mesoscale domains with 33 ensemble members per date
- 9 case dates for LES domains with average of 4 ensemble members per date



LASSO-CACTI simulation for 25-Jan-2021 20 UTC with 100 m grid spacing. Red/blue shading is up/down-drafts for cloud cores. Streamlines are seeded at 2 km (white to purple) and 5 km (light to dark green) above sea level, which turn darker when within cloud.

Total data size is roughly 2 PB for the scenario.

ARM is uploading data for formal release and updating the Bundle Browser for reviewing and downloading simulations. Contact William Gustafson at lasso@arm.gov for access to work with the simulations.

Accessing via ARM's Computing Cluster

Using LASSO-CACTI through ARM's computing cluster (Cumulus) and Jupyterlab server simplifies accessing the 2 PB of files, which overwhelms most users' resources.

Users can request access to both the Jupyter and Cumulus resources via <https://www.arm.gov/capabilities/computing-resources>.



LASSO-ENA Planning and Feedback



Eastern North Atlantic Observatory, Graciosa Island

LASSO-ENA focuses on maritime boundary layer clouds at ARM's ENA observatory on Graciosa Island. Currently, the LASSO team is gathering information and doing prototype simulations to guide production simulations that will be run later this year and next.

The scenario approach is based on input from the initial proposal from the *LASSO Expansion Workshop* and discussion from the recent *LASSO-ENA Planning Workshop*. There is still time to provide your feedback and help guide this scenario!

Proposed Focal Science Questions

These will help guide priorities when designing the scenario.

1. How do even relatively thin clouds at the ENA site produce detectable precipitation?
2. Is low-cloud precipitation at the ENA site controlled primarily by the availability of condensate, and how sensitive is it to cloud droplet concentration?
3. How do meteorological controls, such as wind speed and turbulent mixing in the planetary boundary layer, affect condensate and precipitation?
4. How strongly are cloud droplet sizes and concentrations related to surface aerosol properties, and what cloud processes are important for controlling the relationship?

We Want Your Input

Current thinking for the scenario is available in the recording and slides from the *LASSO-ENA Planning Workshop* held 27-Jul-2023. Access these online using the QR code to the right.



Send your thoughts about priorities, what you want in case dates, employing the observations, and how to best design the modeling approach:

- Community Discourse forum: <https://discourse.arm.gov/c/lasso/lasso-ena>
- Privately to Gustafson & Vogelmann: lasso@arm.gov

Save the date: Future of LASSO Workshop



Tethered Balloon System Launch Site, TRACER Deployment, Texas

ARM evolves over time, e.g., deploying tethered balloons and uncrewed aircraft, adapting to research needs and opportunities. So should LASSO to ensure ARM provides the highest priority products for the community.

The **Future of LASSO Workshop, to be held 2-3 November 2023**, will evaluate LASSO to improve its effectiveness as well as identify new opportunities and/or approaches for its future.

ArcticShark Uncrewed Aerial System, Oregon



Submit a White Paper to Guide LASSO

Topics at the workshop and invitations to participate in person will be guided by input from submitted white papers.

Watch ARM's emails for the forthcoming request for white papers. Interested parties can contact lasso@arm.gov to be notified about the call when it becomes available.

Bankhead National Forest, Alabama



Topics to Discuss

Broad topics to be addressed at the workshop:

- How have current LASSO datasets been used? What are the most valuable aspects of these datasets?
- What science drivers and ARM observations should be the focus of new, near-term LASSO scenarios?
- How can LASSO link to additional observation products?
- What modeling approaches should LASSO use?
- How can LASSO integrate with other modeling activities?
- What priorities should guide resource management such as storage space?



To be included in LASSO e-mail updates, sign up for the LASSO Information e-mail list at <http://eepurl.com/bCS8s5>

FOR MORE INFORMATION

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Forum: <https://discourse.arm.gov/c/lasso> **Website:** <https://www.arm.gov/capabilities/modeling/lasso/>